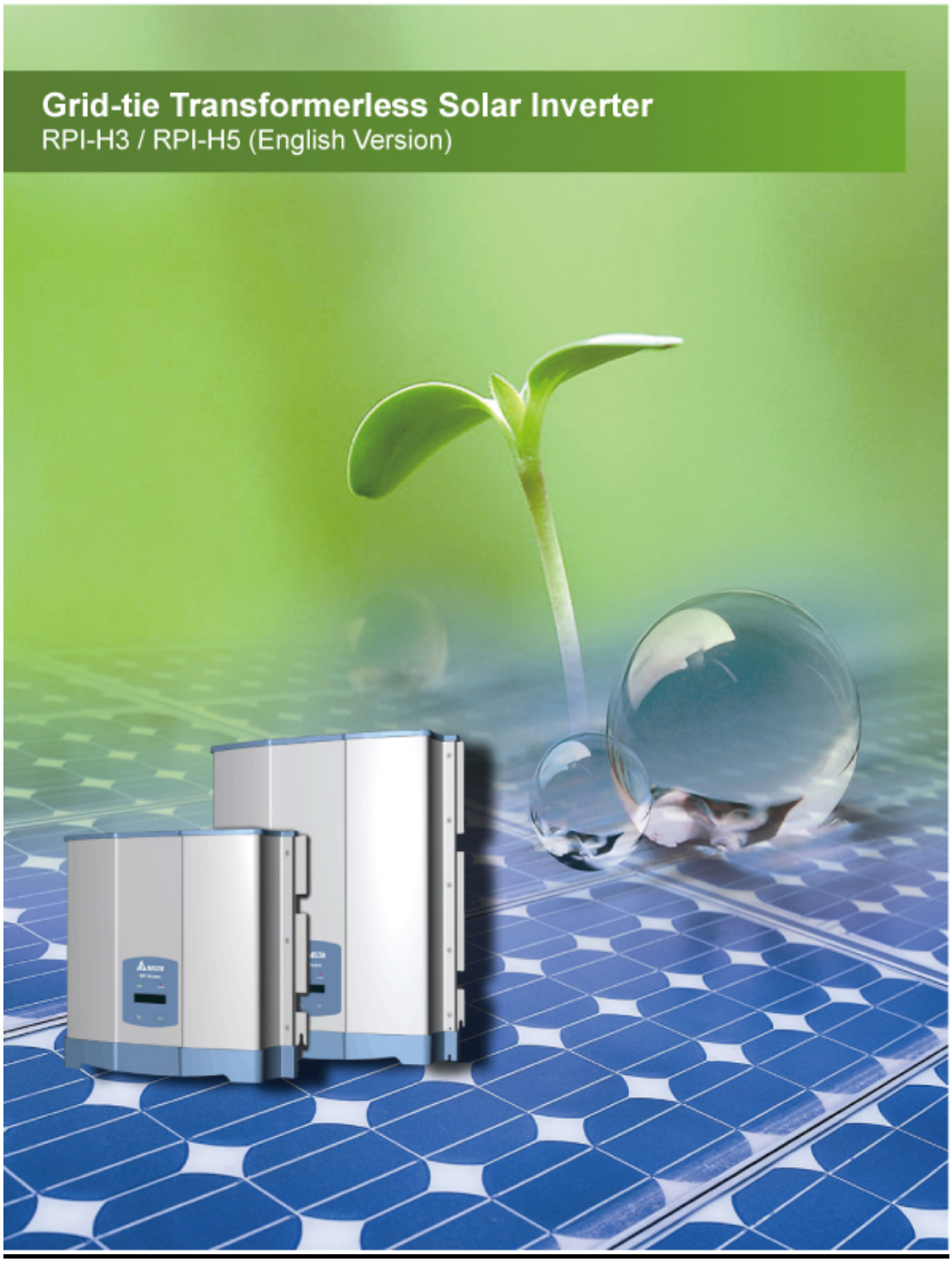
Grid-tie Transformerless Solar Inverter

RPI-H3 / RPI-H5 (English Version)



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1. General Information

1.1 About this Manual

This manual provides the detailed information of specification, installation procedures and all related function settings about the solar inverter model-RPI-H3/RPI-H5. Installation technicians must be well-trained and qualified for installing solar system and must follow all the safety instructions and installation procedures.

1.2 Safety Symbol & Instruction

CAUTION！

Machine and equipment damage may occur if not avoid the hazardous situation

WARNING！

Death and serious injuries may occur if not avoid the hazardous situation

DANGER！

Death and serious injuries will occur if not avid the hazardous situation

WARNING：BURN HAZARD

The enclosure temperature may exceed over 70° C while operating. Danger may occur owing to hot surface. Please do not touch!!

1.3 Validity

This user manual describes the installation procedures, maintenance, technical data and safety instruction of the following solar inverter models under DELTA brand.

- RPI-H3
- RPI-H5

1.4 Product Description

This device is a single phase grid-tie solar inverter. It converts direct current (DC) electricity from photovoltaic power collected from PV Array into single phase alternating current (AC) to feed the excess capacity back to the local main electrical grid.

This inverter allows wide voltage input range (125~550VDC for RPI-H3 and 200~1000VDC for RPI-H5) and high performance efficiency based on user's friendly operation design. In addition, special DSP(Digital Signal Processor)design decreases the circuit complication and electronic components. Please note that this device does not support off-grid function. The features for RPI-H3/RPI-H5 are shown below.

Features

- Power Rating：3 kVA(RPI-H3), 5 kVA(RPI-H5)
- Single Phase (L + N + PE), Grid-tie, Transformerless solar inverter
- Maximum efficiency：> 97.0%(RPI-H3), > 97.5 %(RPI-H5)
- Europe efficiency: 96.2(RPI-H3), 97.0%(RPI-H5)
- Reactive power capability (Cap 0.8 – Ind 0.8)
- Total harmonic distortion (THD < 3%) @ full load
- 1 MPP Trackers
- 16×2 LCD display

1.5 How it Works

The operation of solar inverter is shown as the *Figure 1-1*. In order to save energy and electricity, solar inverter convert the DC input power supplied from the PV Array into single-phase AC output power to Grid.

Figure 1-1 Solar inverter system operation illustration

1.6 Additional Information

For more detailed information for RPI-H3/RPI-H5 or other related product information, please visit http://www.deltaww.com .

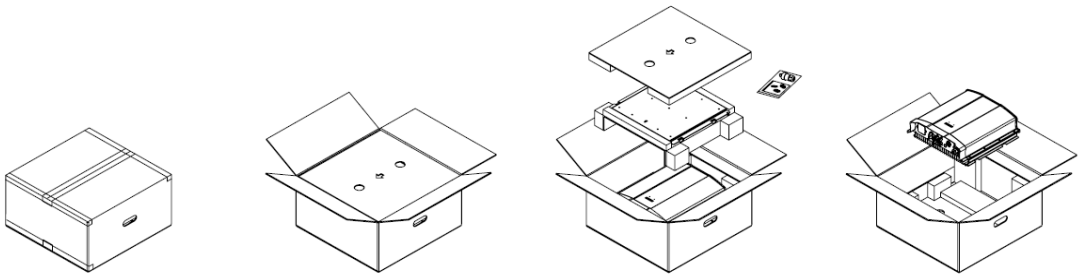
2. Installation and Wiring

2.1 Instruction before Installation

Due to variety of users' installation environment, reading this manual thoroughly before installation is strongly recommended. All the installation and start-up procedures must be undertaken by professional and well-trained technician.

2.2 Unpacking

Unpacking process is shown as *Figure 2-1*.



a. b. c. d.

Figure 2-1 Unpacking process

2.3 Package Inspection

Unknown situations may occur during shipments. Please check if there is any damage on the wooden carton. After opening the package, please check both outer case and inner part of this inverter as below.

Check the right side of the case to ensure the model number and the specification is the same as the model you purchased previously.

1. Check the inverter model number and the specifications are the same as the model you purchased previously.
2. Check if the is any loose component.
3. Check if all the accessories are in the package, the standard accessories are list as Table 2-1:

Table 2-1 Packing list

RPI-H3/RPI-H5		
Object	Qty	Description
PV Inverter	1	3kVA(RPI-H3), 5kVA(RPI-H5) solar inverter
User Manual	1	The Instruction to provide the information of safety, Installation, specification, etc.
AC Plug	1	Connector for AC connection
Wall-Mounting Bracket	1	Wall-mount bracket to mount the solar inverter securely on the wall
M5 Nut	2	To fix solar inverter on the bracket
Spring Washer	2	To fix solar inverter on the bracket
Plain Washer	2	To fix solar inverter on the bracket

Caution: When there is any outer or inner damage on inverter or any incompleteness or damages on the packaged accessories, please contact your inverter supplier.

2.4 Identification Label

Users can identify the model number by the information on the product label. The model number, specifications as well as the series No. is specified on the product label. Regard to the label location, please refer to *Figure 2-2*.

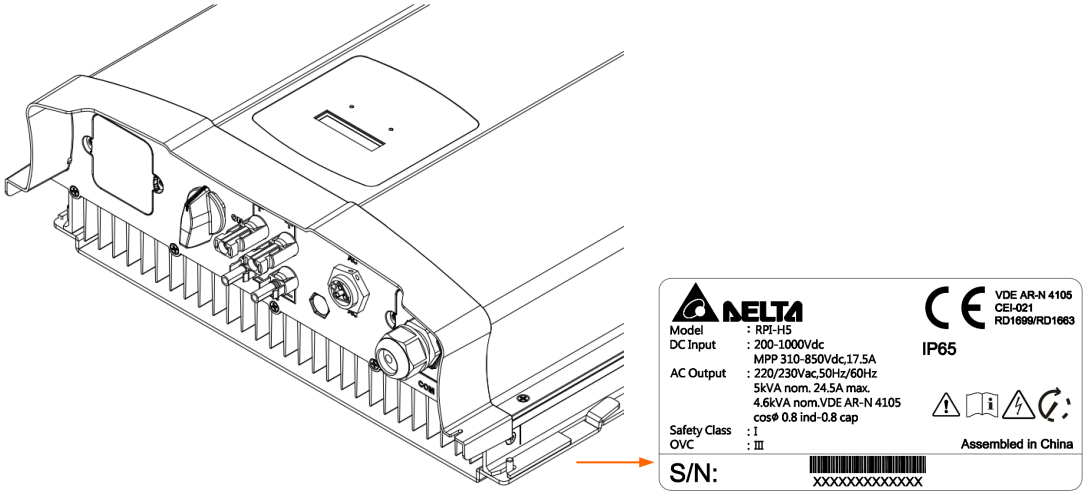


Figure 2-2 The identification label

3. Product Overview

3.1 Dimension

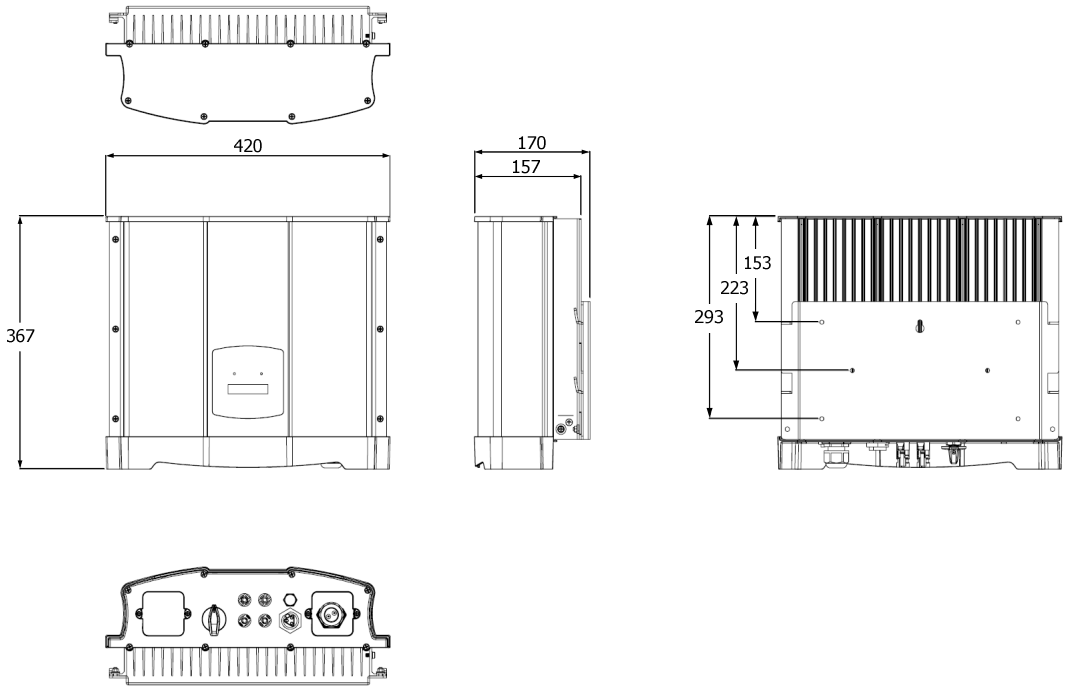


Figure 3-1 Dimension of RPI-H3

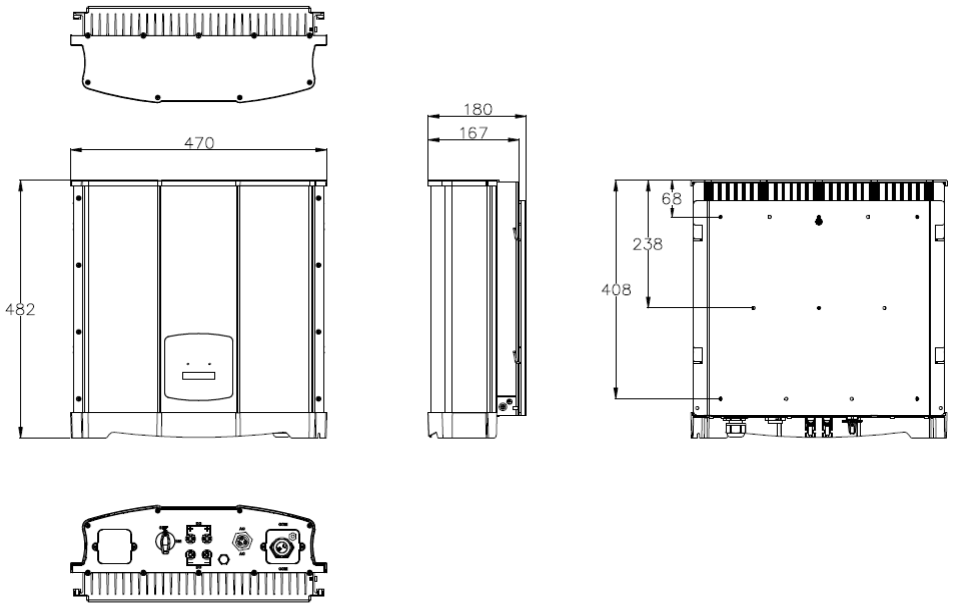


Figure 3-2 Dimension of RPI-H5

3.2 Function Introduction

Inverter's exterior objects are shown on the *Figure 3-3*, and the detailed description is in sections 3.2.1 and 3.2.2.

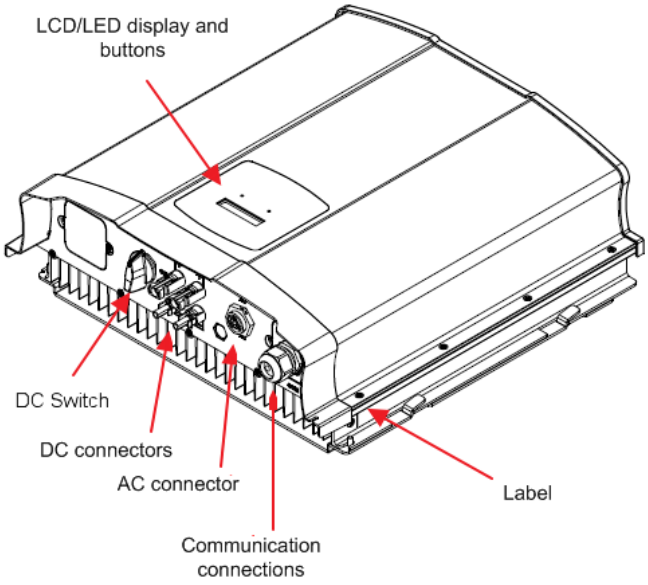


Figure 3-3 Inverter exterior objects

3.2.1 LCD Display and Buttons

Figure 3-4 LCD display and buttons

3.2.2 Inverter Input/Output Interface

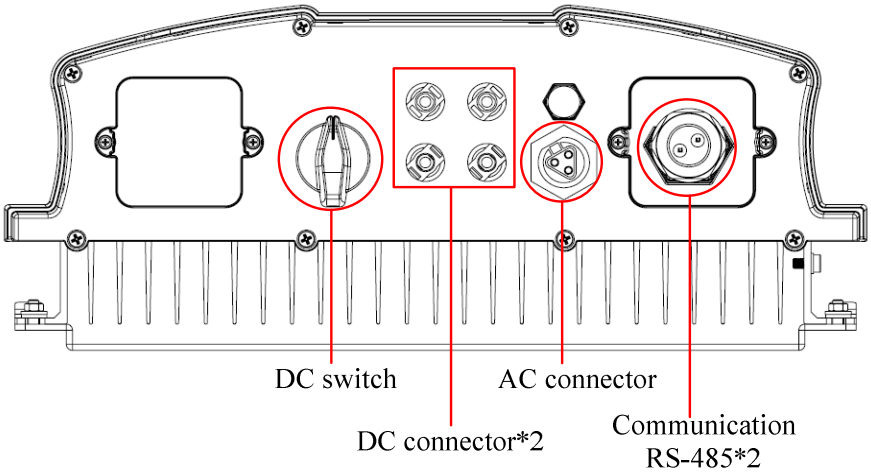


Figure 3-5 Input/Output interface

4. Installation

4.1 Installation Location

WARNING！ Death and serious injuries may occur.

- Do not install the unit near/on the flammable objects.
- Please mount the unit tightly on the solid/smooth wall.
- In order to ensure the safety of installers, installer shall be at least two people to process the installation.
- When moving the Inverter, installer shall not stand under machines.

CAUTION！ Machine and equipment damage may occur

- Do not install the unit at the location that directly expose to sunlight.

4.2 Mounting

This unit is a wall-mounting system. Please ensure the installation is perpendicular and with AC plug at the bottom. Do not install the device on a slanting wall. The dimensions of mounting bracket are shown as figure below. There are 7 pcs(RPI-H3)/12pcs(RPI-H5) of M5 screws required for mounting plate. Fix the supplied wall-mount plate securely on the wall before mounting the inverter to the mounting plate.

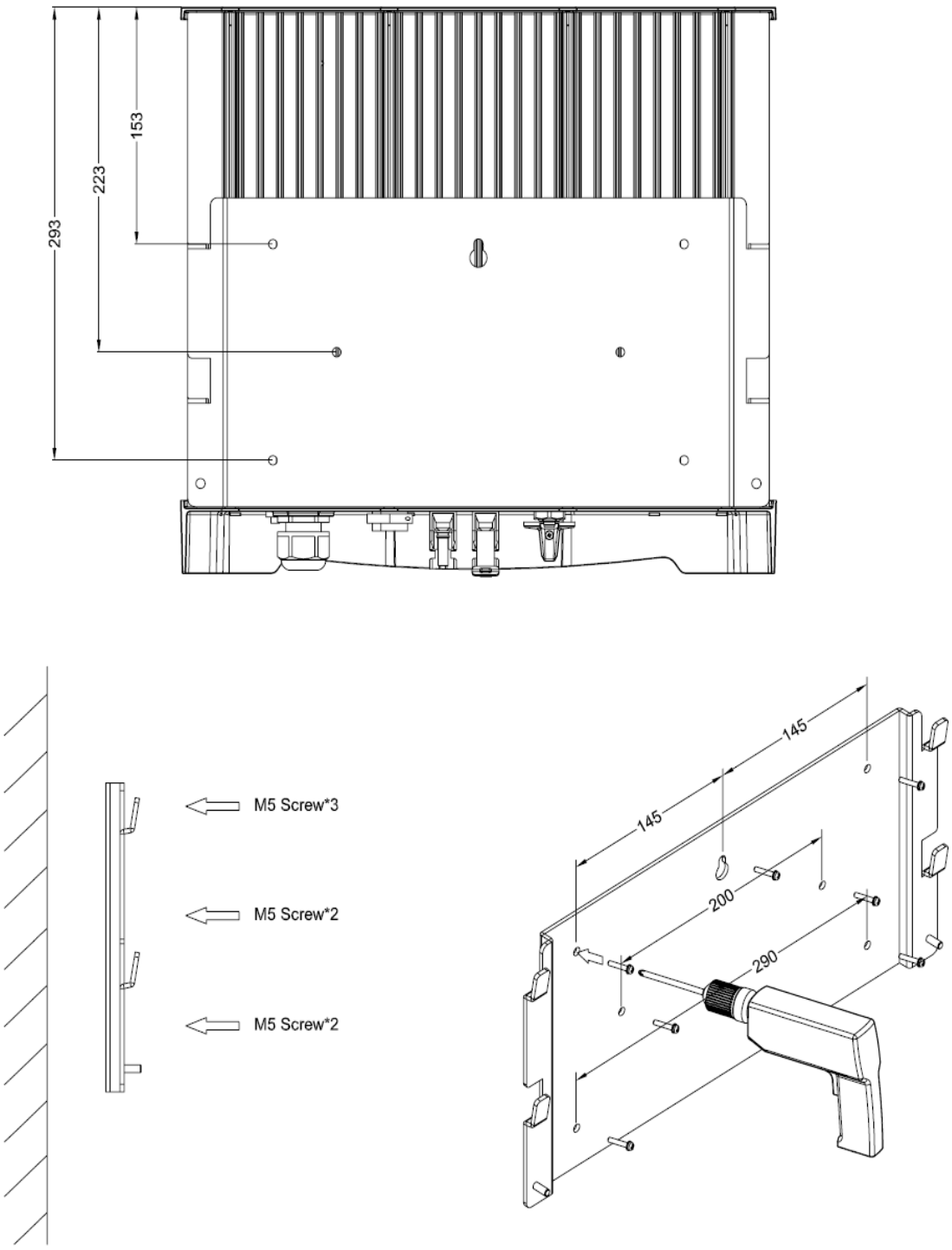


Figure 4-1 Screw the mounting bracket for RPI-H3

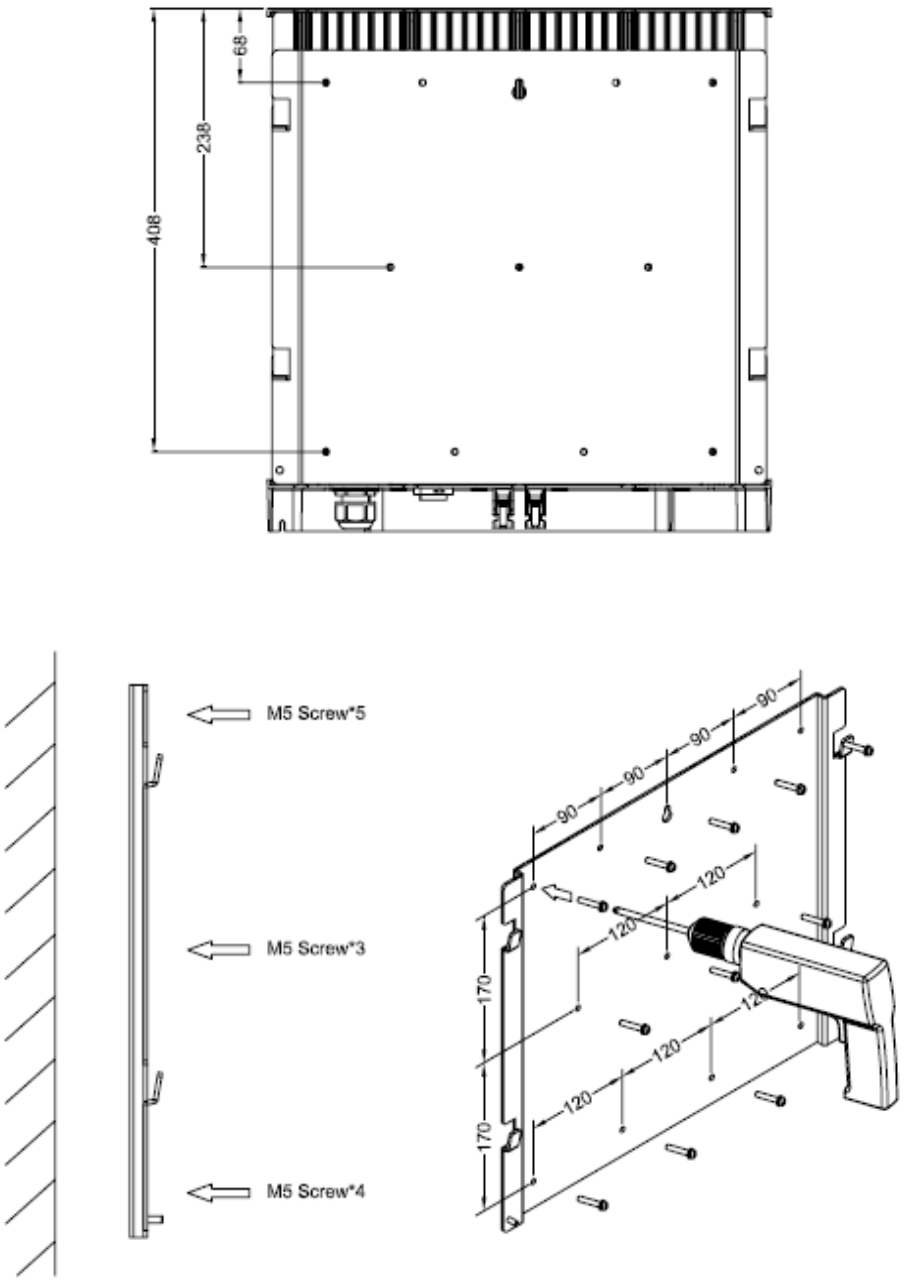


Figure 4-2 Screw the mounting bracket for RPI-H5

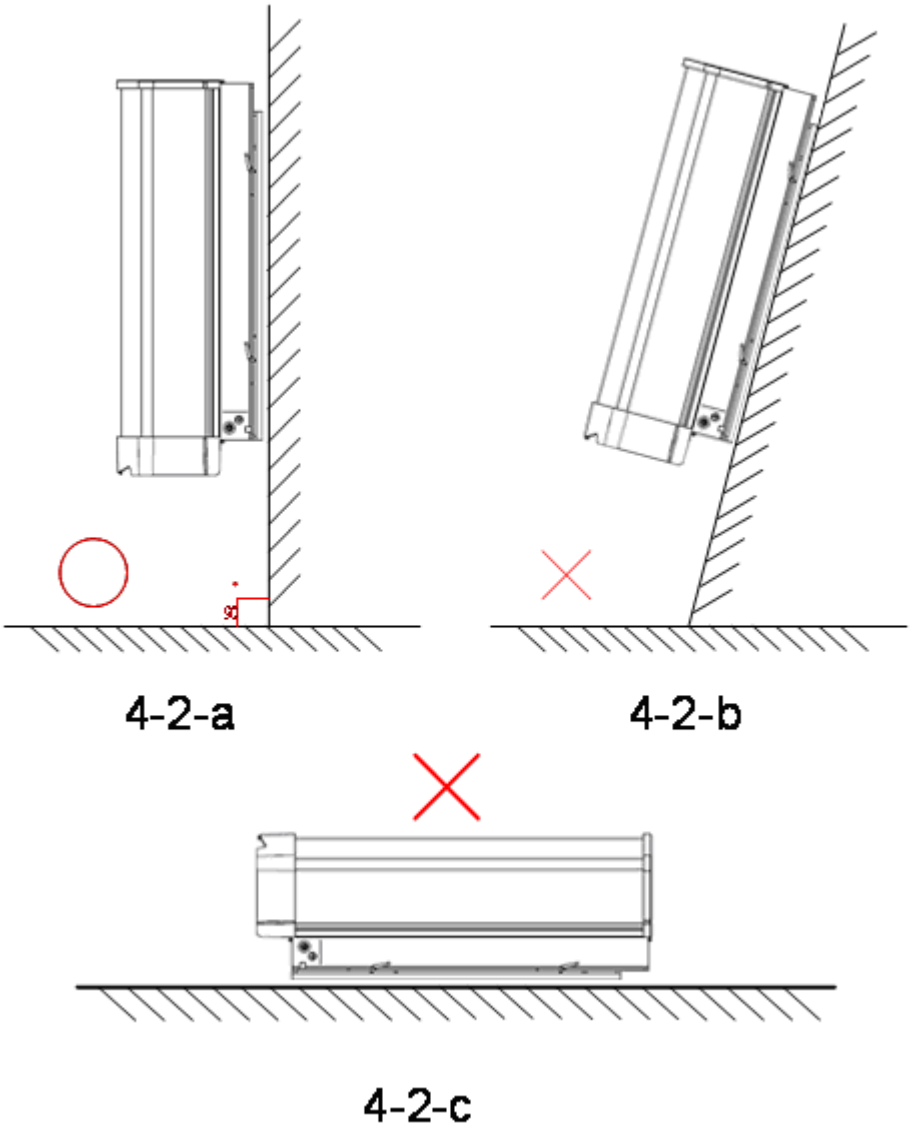


Figure 4-3 Correct and incorrect installation illustration

CAUTION

- The location and hardware should be a solid surface or a firm holder that suitable for the weight of inverter.
- Suggested to install the inverter to the location which offers free and safe access. It would streamline the service and maintenance
- Please leave an appropriate gap in between when installing singe/ several solar inverter systems.
- Please install solar inverter at an eye level to allow easy observation for operation and parameter setting.

◆ Ambient temperature -20℃~60℃.(power derating above 40℃)

There shall be sufficient space for product operation as shown as the *Figure 4-4*. If necessary, installer can increase the gap space for sufficient operation space.

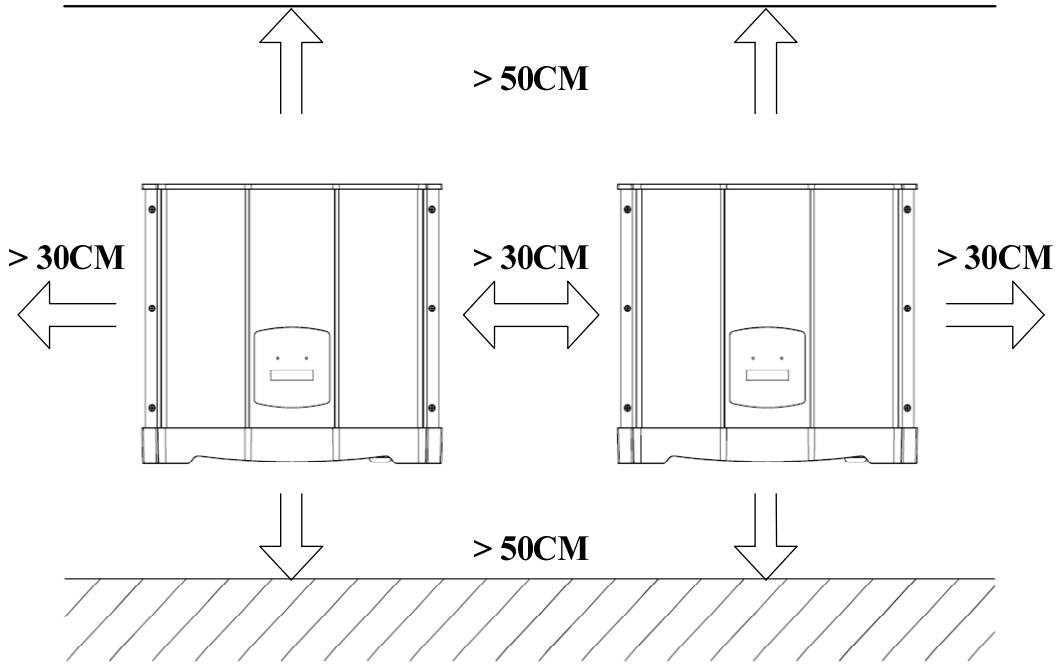


Figure 4-4 Proper installation gap

5. Wiring

5.1 Preparation before Wiring

1. Make sure whether the voltage values, polarities are correct.
2. When grounding of the solar array is necessary, an isolation transformer is required due to the RPI-H3/RPI-H5 not having a galvanic isolation between the DC-input and AC-output.
3. The ground fault detection is a fixed internal setting. It always works and can not be modified.
4. The whole system wiring is shown as in *Figure 5-1*.

◆ Please refer to *Figure 5-1* for the connection. Inverter can accept DC inputs in parallel (1 MPP tracker/2 parallel inputs).

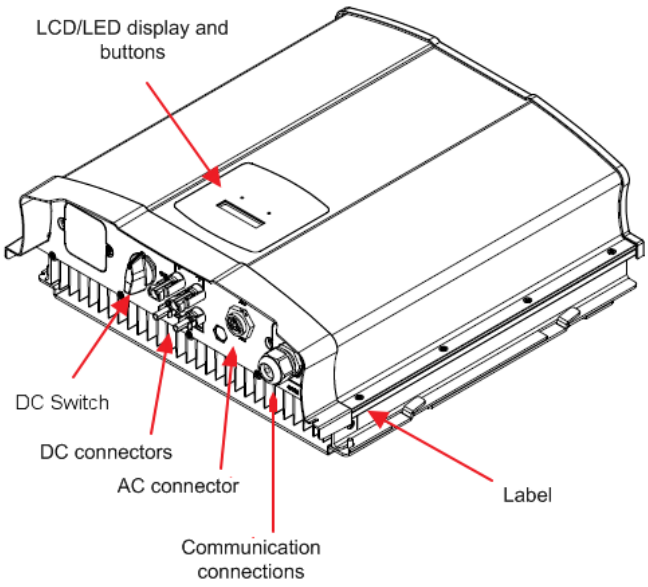


Figure 5-1 Connection of system

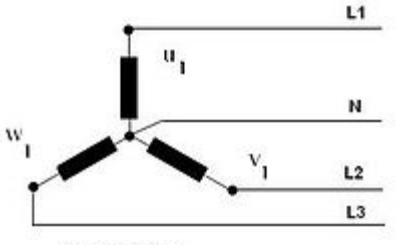
WARNING！ SHOCK HAZARD

● Whenever a PV array is exposed to sun-light, a shock hazard exists at the output wires or exposed terminals. To reduce the risk of shock during installation, cover the array with an opaque (dark) material and ensure that Disconnect Device is set to OFF before commencing any wiring.

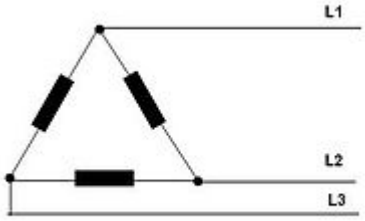
5.2 AC Grid Connection: L + N + PE

WARNING! Death and serious injuries may occur.
Before AC wiring, please ensure AC breaker is switched off.

For RPI-H5, users must aware that AC configuration Setting must be set correctly otherwise this device can not work. There are two types of AC configurations (shown in *figure 5-2*) that are used in electricity systems. For "AC Configurat." setting please see chapter 7.2.2



Star configuration (3 phases + Neutral): L–N (default), The voltage between each phase and the neutral is 230/220 V. The voltage between two phases is 400/380V.



Delta configuration (3 phased wires only) : L–L, The voltage between two phases are 230/220V. As there is no neutral, there is no phase-neutral voltage.

Figure 5-2 AC configurations

5.2.1 Required protective devices and cable cross-sections

Recommended upstream protection

Power rating	Upstream circuit breaker
3.75kVA(RPI-H3), 6.25 kVA(RPI-H5)	20A(RPI-H3), 30A(RPI-H5)

Please use proper wire to connect correct poles (According to the Table 5-1).

Table 5-1 AC wire requirement

Current Rating	Wire size	Torque
>20A (RPI-H3), >30 A (RPI-H5)	3-4mm^2 / 12 AWG	0.8~1Nm

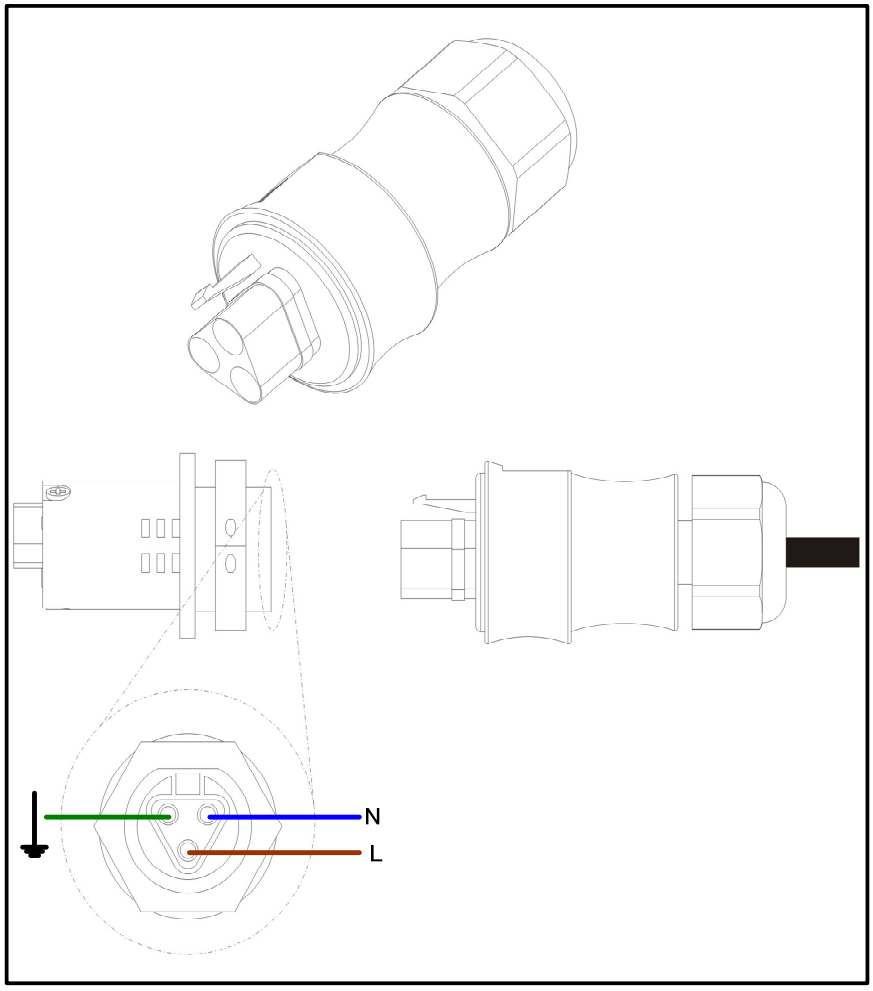


Figure 5-3 AC plug illustration

- The AC voltage should be as following.
  L-N: 230 Vac± 10

5.3 DC Connection (from PV Array)

WARNING !

- When doing DC wiring, please choose the proper wiring by connect to the correct polarity.
- When doing DC wiring, please confirm that PV Array's power switch is off.

CAUTION !

- The maximum open circuit voltage of PV Array must not exceed 550V (RPI-H3) / 1000V (RPI-H5).
- The recommended PV power connect to inverter is 3600W

(RPI-H3) / 5950W (RPI-H5).

- The device installed between PV Array and inverter must meet the rating of voltage higher than this device's maximum input voltage.

Cable size:

Current Rating		Wire size
DC 15 A (RPI-H3)	DC 17.5 A (RPI-H5)	2-3mm^2 / 14 AWG

DC wiring polarities are divided into positive and negative, which is as shown in *Figure 5-4*. The connection shall be coherent with the indication marked on inverter.

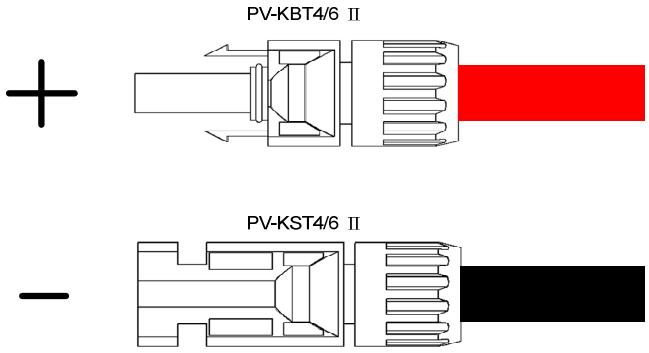


Figure 5-4 DC Wiring illustration

5.4 Communication Module

The Communication Module supports the function of communication with computer, and provides 2 ports of RS-485 .When using this module, the first step is to take off the cover located at the right bottom of inverter and pull out the RS485 socket as shown in *Figure 5-5*.

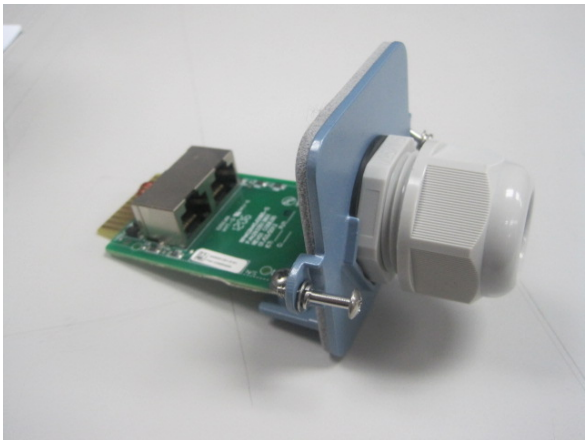


Figure 5-5 Communication module

5.4.1 RS-485 Connection

The pin definition of RS-485 is shown as in Table 5-2 and protocol settings are listed in Table 5-3. The wiring of multi-inverter connection is shown as *figure 5-6*. .

Table 5-2 Definition of RS485

PIN	FUNCTION
1	N/C
2	N/C
3	N/C
4	DATA-
5	DATA+
6	N/C
7	GND
8	12 Vdc

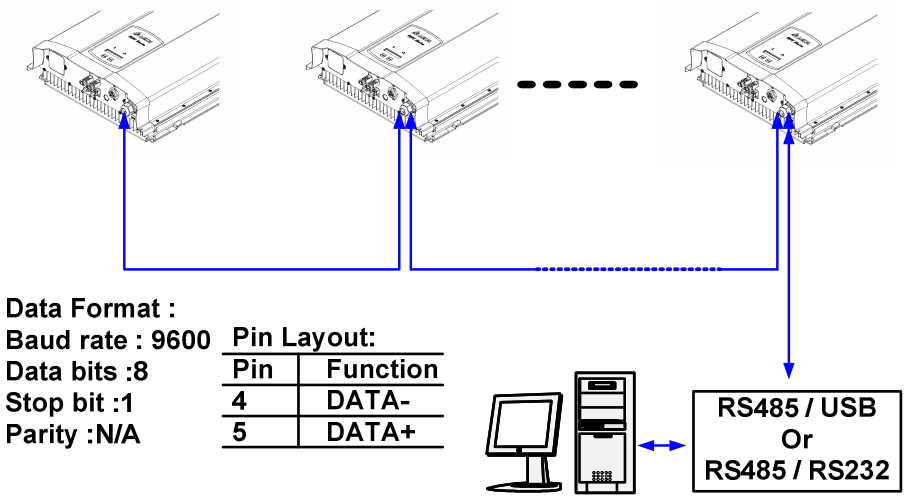


Figure 5-6 Multi-inverter connection illustration

Table 5-3 RS-485 data format

RS-485 Data format	
Baud rate	9600
Data bit	8
Stop bit	1
Parity	N/A

6. Active/Reactive Power Control and Low Voltage Ride Through (Optional)

There are 2 settings for active power and 4 settings for reactive power control based on the requirement from network operator.

6.1 Active Power Control

6.1.1 Power Limit

Users can reduce inverter output power by set percentage of actual or rated power.

6.1.2 Power vs. Frequency

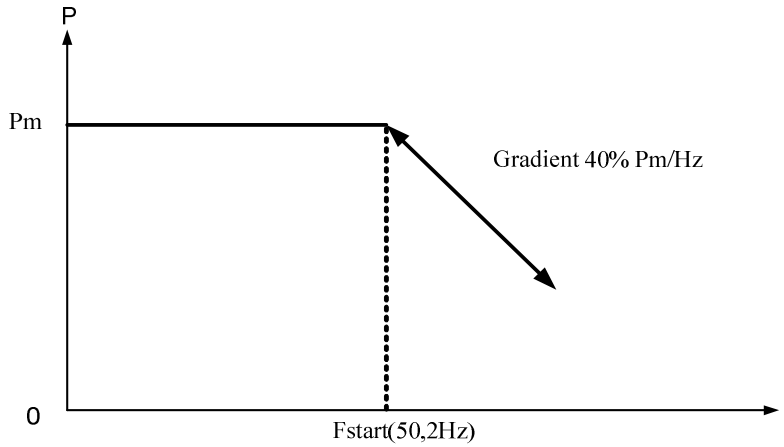
According to VDE-AR-N 4105 (5.7.3.3)：

At frequencies between 50.2Hz and 51.5Hz, all adjustable power generation systems shall reduce (for frequency increase) or increase (for frequency decrease) the active power Pm generated instantaneously (at the time of exceeding the mains frequency 50.2Hz; freezing the value on the current level) with a gradient of 40% of Pm per Hertz).

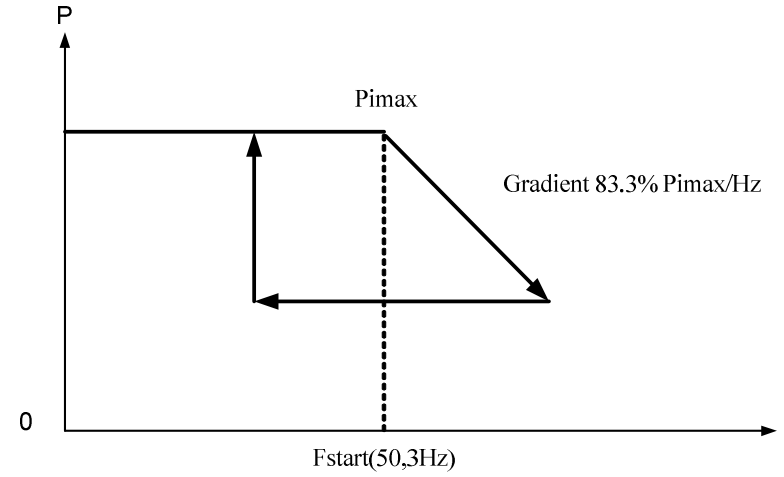
According to CEI 0-21 (8.5.3.2)：

Within a frequency range from 50.3Hz to 51.5Hz, all adjustable production plants equipped with static converters have to be able to reduce the currently generated active power in case of an increase of the frequency with a variable droop of 2% to 5% with a default value of 2.4% (with corresponds to a power gradient of 83.3%/Hz).

User can set all necessary settings to meet the requirements from network operator. Please refer to actual Power vs. Frequency for the settings procedure.



Power vs. frequency curve for VDE-AR-N 4105



Power vs. frequency curve for CEI-021

Figure 6-1 Power vs. frequency characteristic

6.2 Reactive Power Control

With active power output, it must be possible to operate the generating plant in any operating point with at least a reactive power output corresponding to a active factor at the network connection point of

cos φ = 0.8 underexcited to 0.8 overexcited

(VDE-AR-N 4105,CEI 0-21 cos φ = 0.9 underexcited to 0.9 overexcited)

Values deviating from the above must be agreed upon by contract. With active power output, either a fixed target value for reactive power provision or a

target value variably adjustable by remote control (or other control technologies) will be specified by the network operator in the transfer station. The setting value is either

1. fixed power factor cosφ (VDE-AR-N 4105 ,CEI 0-21)
2. displacement factor/active power characteristic curve cosφ(p) (VDE-AR-N 4105 ,CEI 0-21)
3. fixed reactive power in Var.(CEI 0-21)
4. reactive power/voltage characteristic Q(U). (CEI 0-21)

6.2.1 Fixed Power Factor cosφ (VDE-AR-N 4105,CEI 0-21)

Users can set power factor from Cap 0.8 to Ind 0.8 (inverter would stop reactive power control if output power is below 20% rated power). \

6.2.2 cosφ(P) (VDE-AR-N 4105,CEI 0-21)

Once user enables this method, inverter will deliver reactive power according to output active power at that moment. *Figure 6-2* is an example.

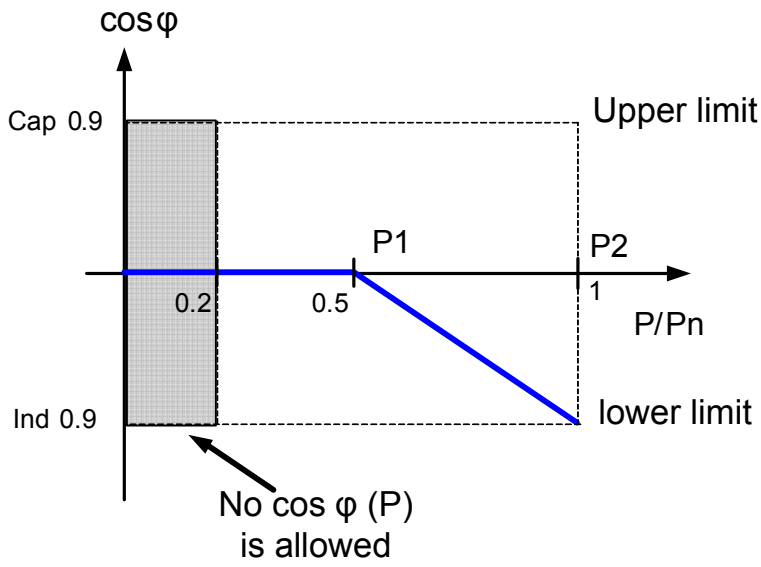


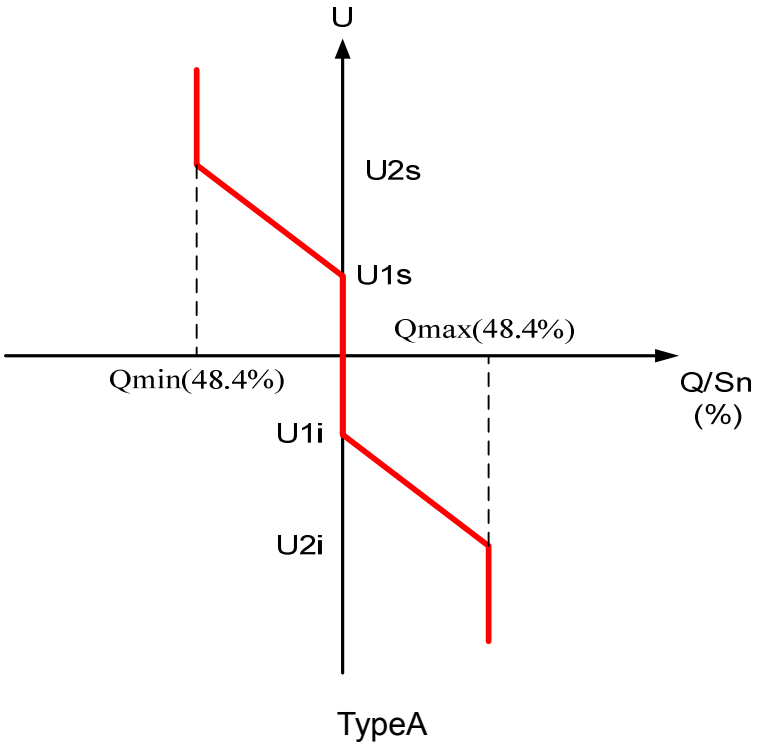
Figure 6-2 cosφ(P) characteristic

6.2.3 Fixed Reactive Power In Var.(CEI 0-21)

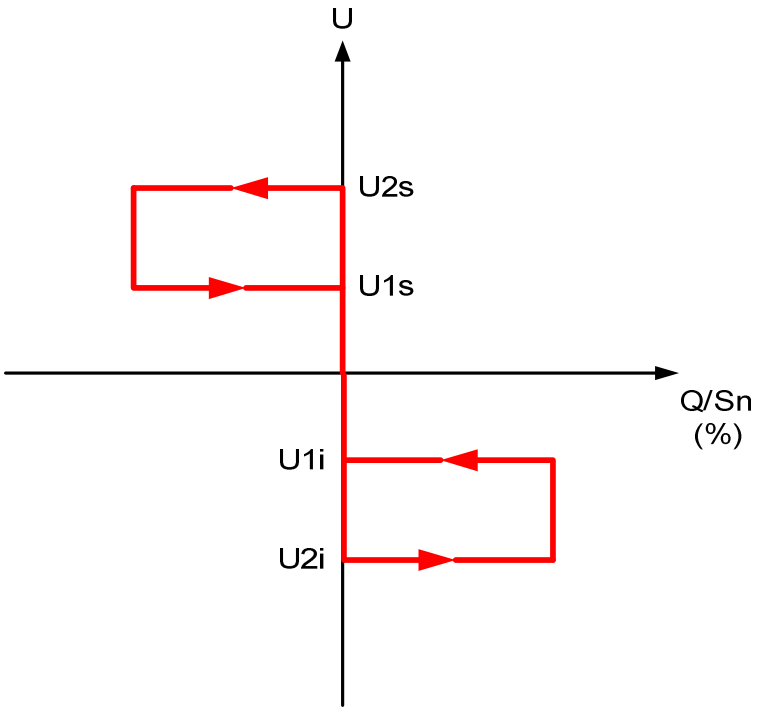
Once user enables this method, inverter will deliver reactive power (ie. Q) according to the fixed reactive power setting. The setting range is from Cap 48.4% to Ind 48.4%.

6.2.4 Reactive Power / Voltage Characteristic Q(U)(CEI 0-21)

Once user enables this method, user can set Q vs. Grid voltage operation curve as below.



TypeA



TypeB

Figure 6-3 Q(U) characteristic

6.3 Low Voltage Ride Through (LVRT)

According to CEI 0-21, 8.5.1

To avoid undue separation from the network if voltage dips occur, a generation system with over 6 kW total power must be able to comply with certain functional requirements, which are known as LVRT(Low Voltage Ride Through) in international literature.

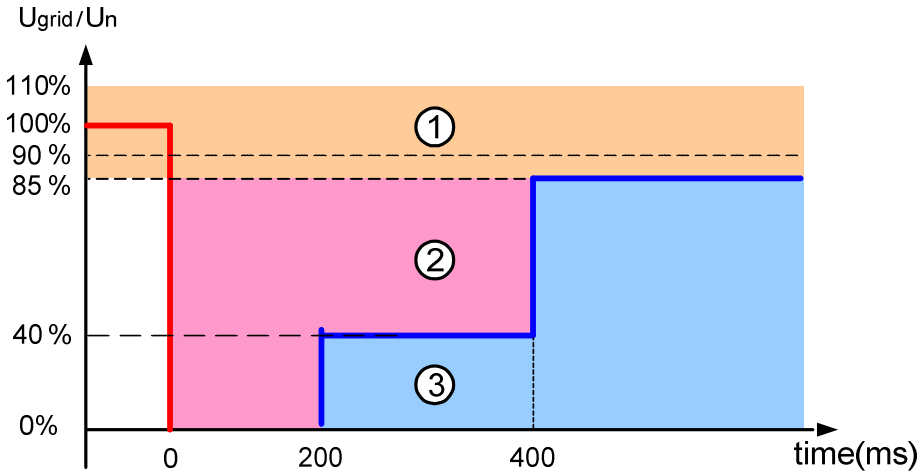


Figure 6-4 LVRT characteristic

7. Turn on/off PV inverter

WARNING：BURN HAZARD

The enclosure temperature may exceed over 70℃ while operating. Danger may occur owing to hot surface. Please do not touch!

After installation, please confirm the AC, DC, and Communication connection are correct. When solar irradiation is sufficient, the device will operate automatically after no mistakes on self-auto test (about 2 minutes at 1st startup of a day). The display includes 16×2 LCD display and LED indicator for inverter status. There are green and red colors for LED indicator to represent different inverter working status.

7.1 Start-up Procedures

7.1.1 PV Array DC Voltage Checking

1. Uncover the PV arrays and expose them to full sunlight. The sunlight must be intense enough to produce the required output voltage.
2. Measure the PV array open circuit DC voltage across the DC positive (+) and negative (-) terminals.

7.1.2 AC Utility Voltage Checking

Using an AC voltmeter measures the AC open circuit utility voltage between L1 (L) and L2 (N). Ensure the voltage is at approximately the nominal value. The inverter operates with a line-to-line voltage range around the nominal value.

See “11. Technical data”, output section for the utility voltage operating range for your inverter model.

7.1.3 Starting up the Inverter

1. Switch the DC and AC disconnection switches (breakers) to “ON”.
2. Check the inverter LCD. The startup screen should appear in several seconds, (for the first time start up, select proper country and language. See “7.3.2 Country Selection & 7.3.3 Language Selection”).

7.2 Inverter Setting

7.2.1 Country Setting

The first time you startup this device. Country Setting is required.

1. In the country setting page, press “SEL” button (NEXT) to select your located country, press “ENT” button to confirm this page.
2. Press “Enter” button to confirm your country setting.

NOTE:

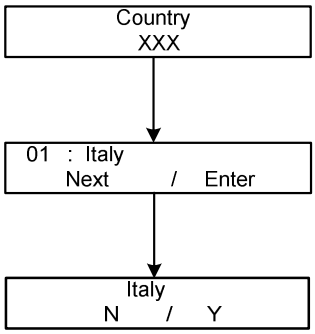


Figure 7-1 Country Setting

7.2.2 AC Configuration Setting

1. Turn on DC power and wait for the LCD display is ready, then press “SEL” button until “Country XXX" is displayed.

2. Press and hold both “SEL” and “ENT” buttons for 10 seconds until “Language XXXXXX” is shown.

3. Press “SEL” until “AC Configurat. XXXXXX” is shown.

4. Press “ENT” to enter **AC Configuration Setting** page, press “SEL” to flip between two types of configuration. As your type of configurations is displayed, press ”ENT” to confirm the setting.

System Information

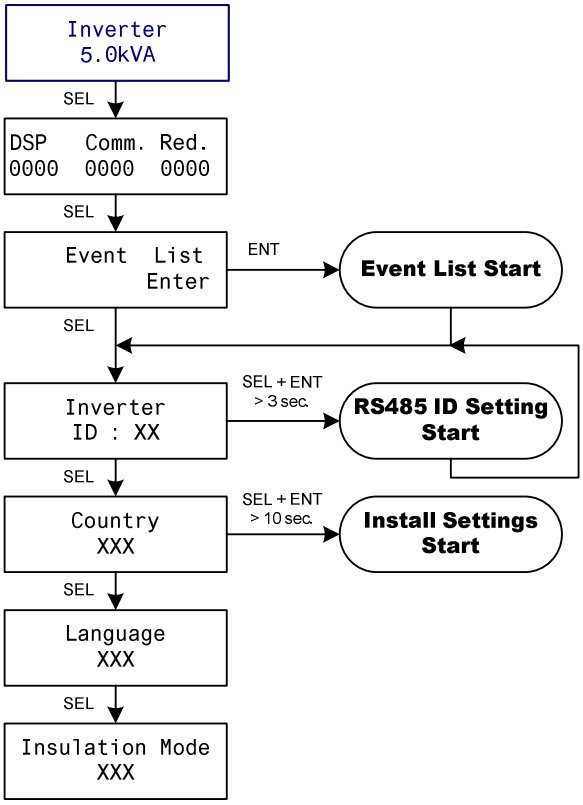


Figure 7-2 AC Configuration Setting-1

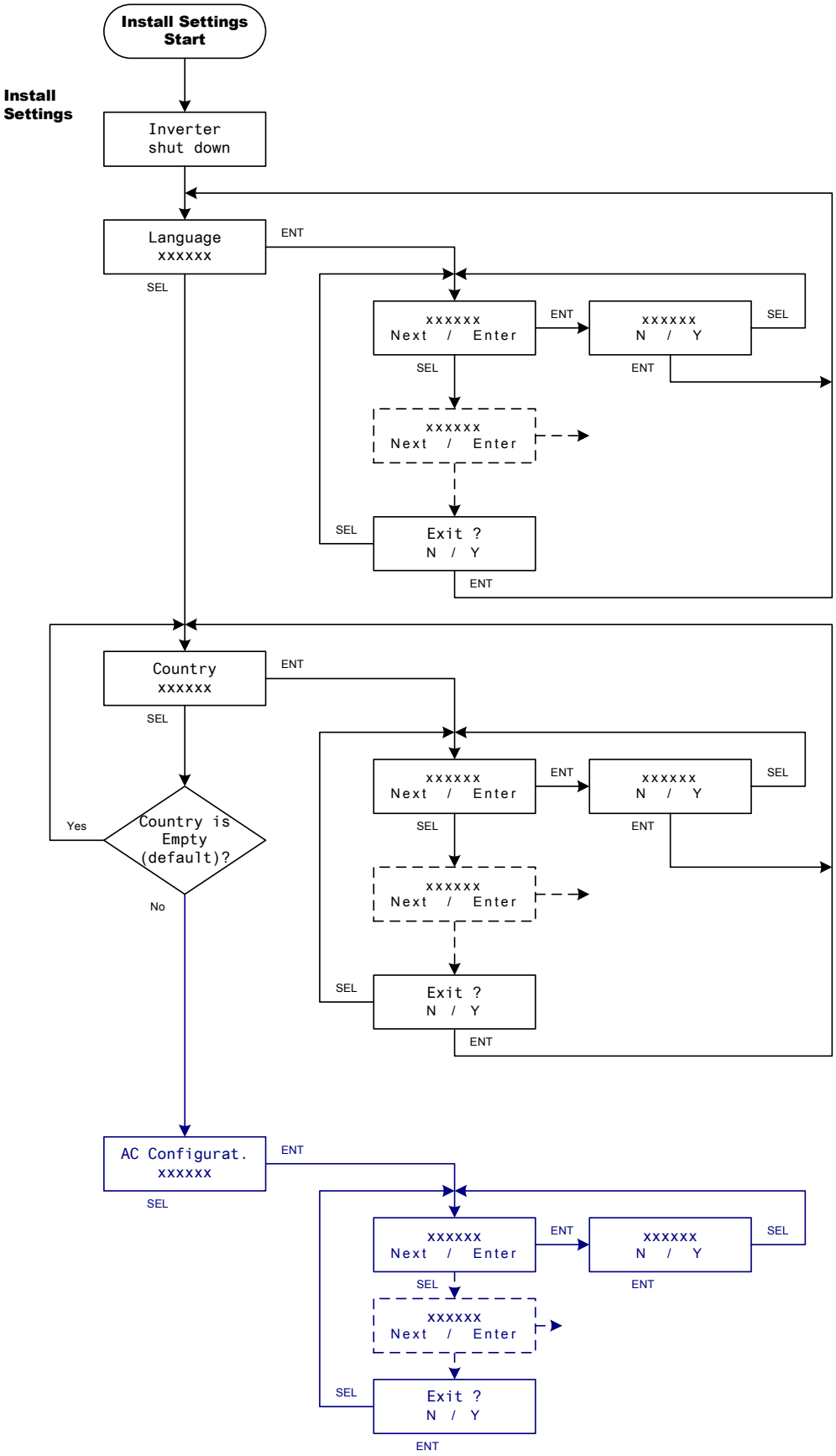


Figure 7-3 AC Configuration Setting-2

7.2.3 Connecting the Communication Wiring

Multiple inverters could be monitored via RS-485 connection (*Figure 5-6*), but each inverter's ID must be set.

NOTE:
Make sure the inverter ID is different from each other in the same train.
Single inverter could be monitored RS-485 connection.

7.2.4 Inverter ID Setting

1. Turn on DC power and wait for the LCD display to be ok, then press "Select" button until "Inverter ID: XX" is shown in the LCD.
2. Press and hold both buttons ("Enter" first then "Select") until entering setting ID screen, then you could release the both buttons and set ID by pressing "Select" button, press "Enter" button if the ID is correct (ID = 1 ~ 254).
3. Inverter ID is changed and saved.

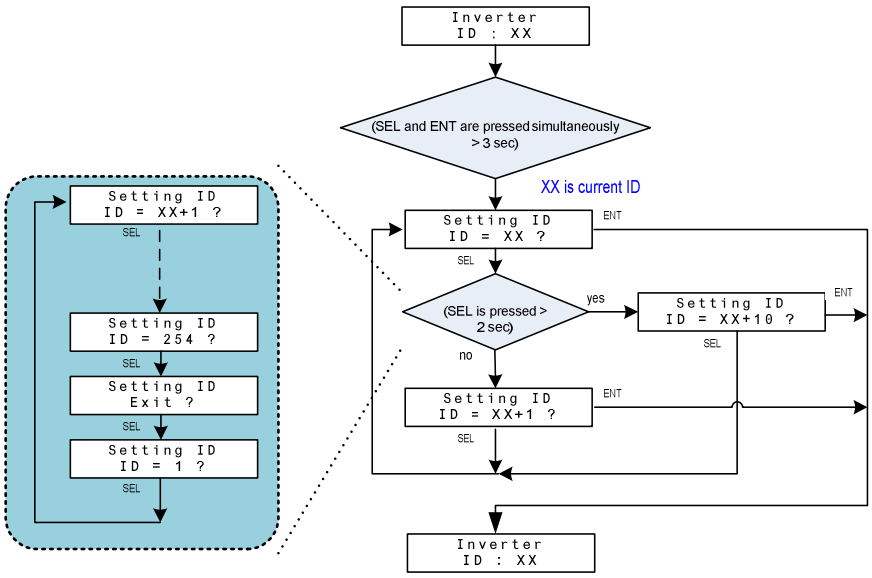


Figure 7-4 Inverter ID Setting

7.3 LCD flowchart

Press any button will enter menu page (*Figure 7-5*), Today Output Energy is home page, and several item is described in section 7.3.1 ~ 7.3.6.

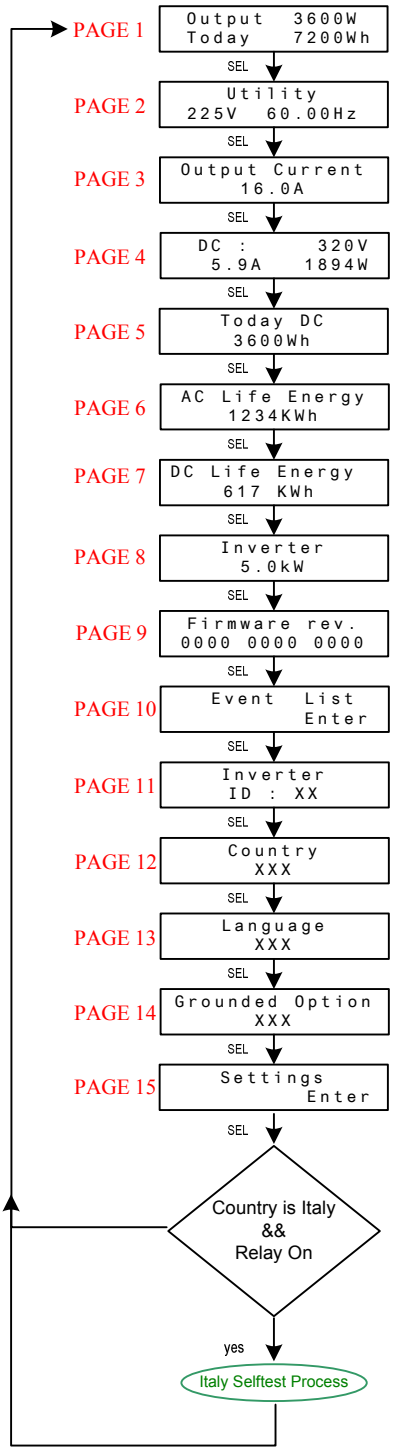


Figure 7-5 LCD flowchart

Page1 Today output energy
Page2 Grid voltage and frequency
Page3 Output current
Page4 Input voltage, current and power
Page5 Today input energy

Page6 Total output energy
Page7 Total input energy
Page8 Start page
Page9 Firmware version
Page10 Event list
Page11 Inverter ID
Page12 Country
Page13 Language
Page14 Grounded option
Page15 Settings

7.3.1 Event List

When entering this page, the display will show all the events (error or fault) and it can show 16 records at most with the latest one on the top.

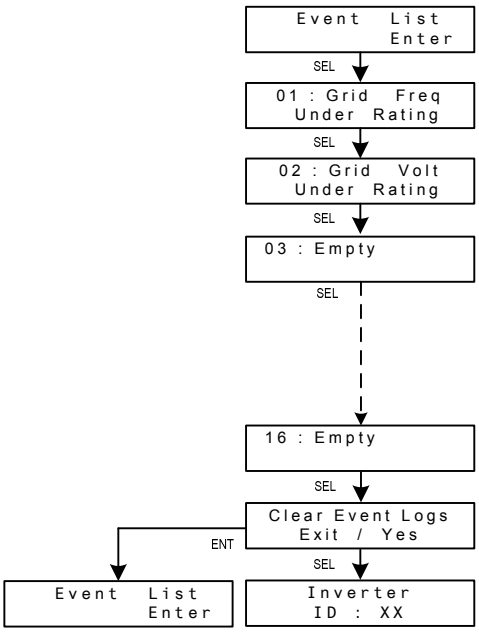


Figure 7-6 Event log flowchart

7.3.2 Country Selection

Users can select different countries in this page.

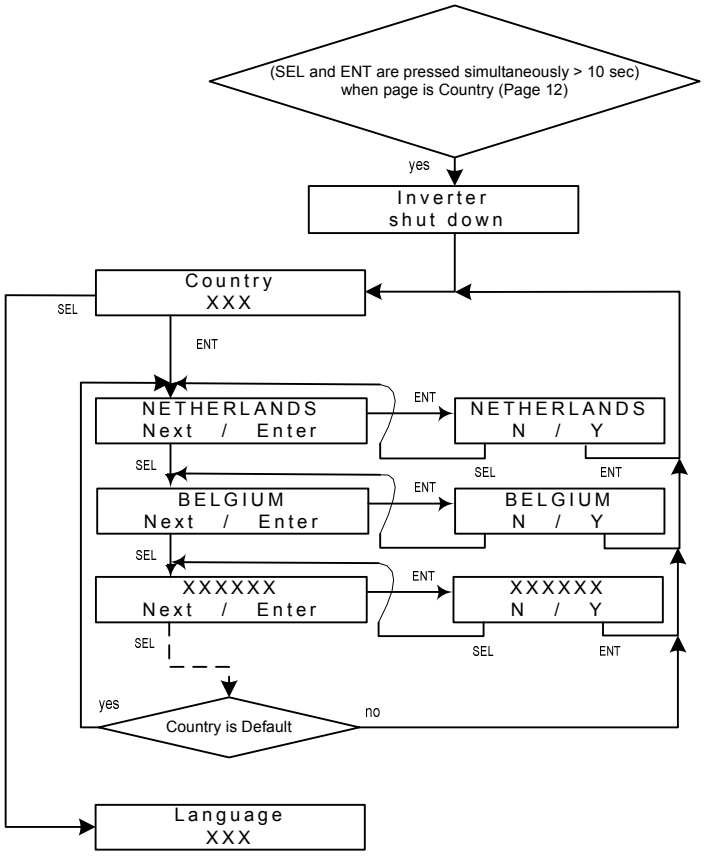


Figure 7-7 Country selection

Table 7-1 Country list

RPI-H3/RPI-H5	
Germany	Denmark
Italy	Israel
Spain	Bulgary
Australia	Czech Republic
France	Italy 6KVA(for RPI-H5 only)
England	Spain1699
Taiwan	Portugal
Greece	China
Belgium	Austria
Netherlands	Ireland

7.3.3 Language Selection

When entering this page, user can set five different languages.

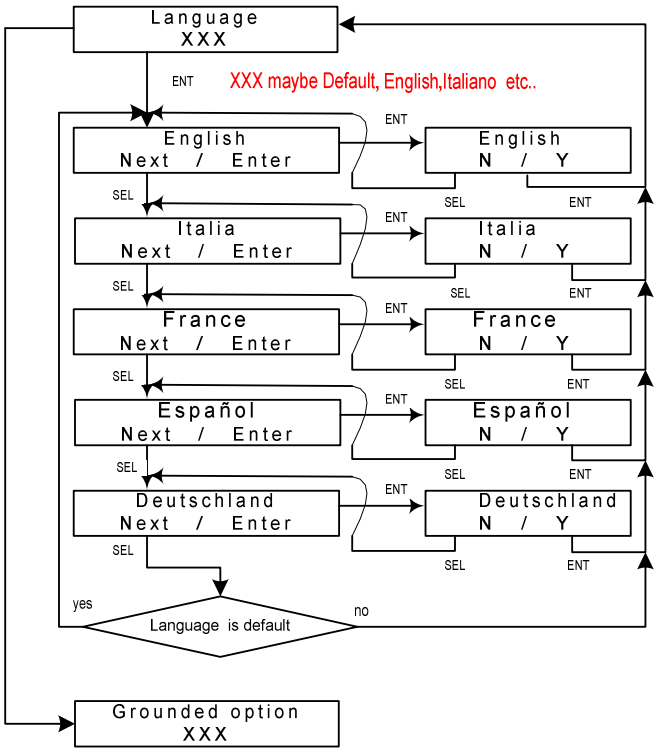


Figure 7-8 Language selection

Table 7-2 Language list

RPI-H3/RPI-H5
English
Italiano
Française
Espanol
Deutsch

7.3.4 Insulation Mode

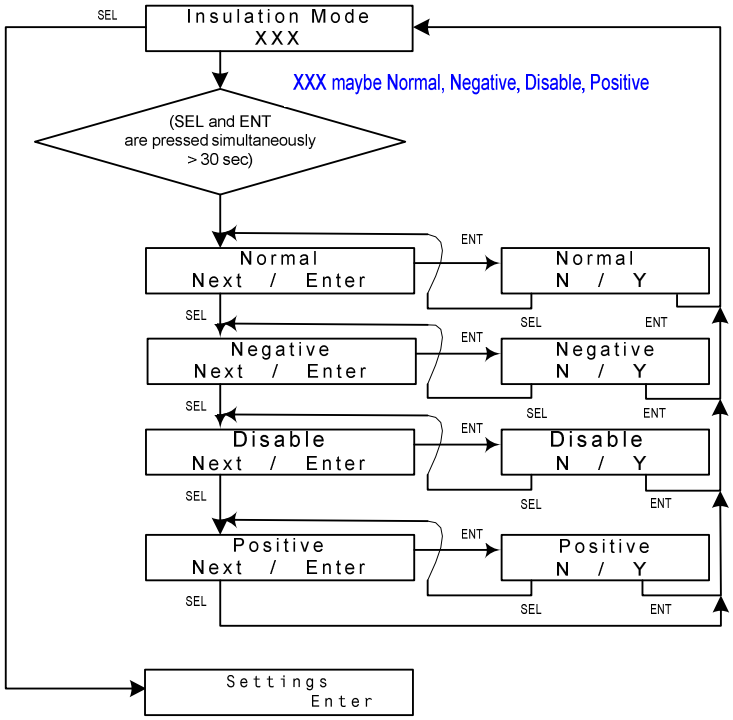


Figure 7-9 Insulation mode

7.3.5 Settings

Setting includes Personal Setting, Coefficients Setting, Install Setting and Italy Self-test. Italy Self-test Setting will only exist when Italy is selected in country setting.

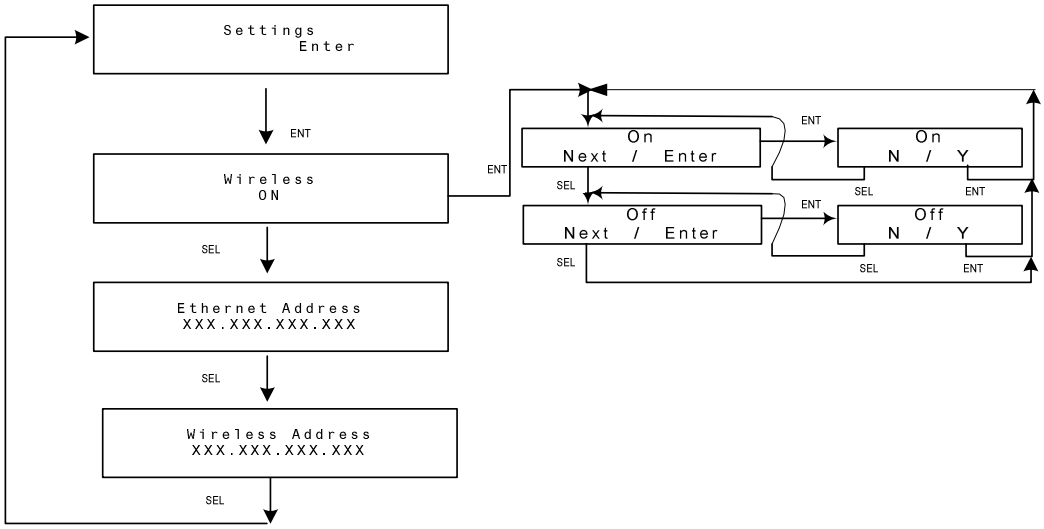


Figure 7-10 Setting page

7.3.6 Italy Self-test

Italy Self-test includes Uac High(UH), Uac Low(UL), Fac High(FH) and Fac Low(FL). User can choose the selection of Uac High, Uac Low, Fac High, or Fac Low separately. The final testing result will be shown on the operating page and saved, user can review the results. If the Italy Self-test failed, this PV inverter would not operate anymore. Please contact with Delta or your supplier of this PV inverter.

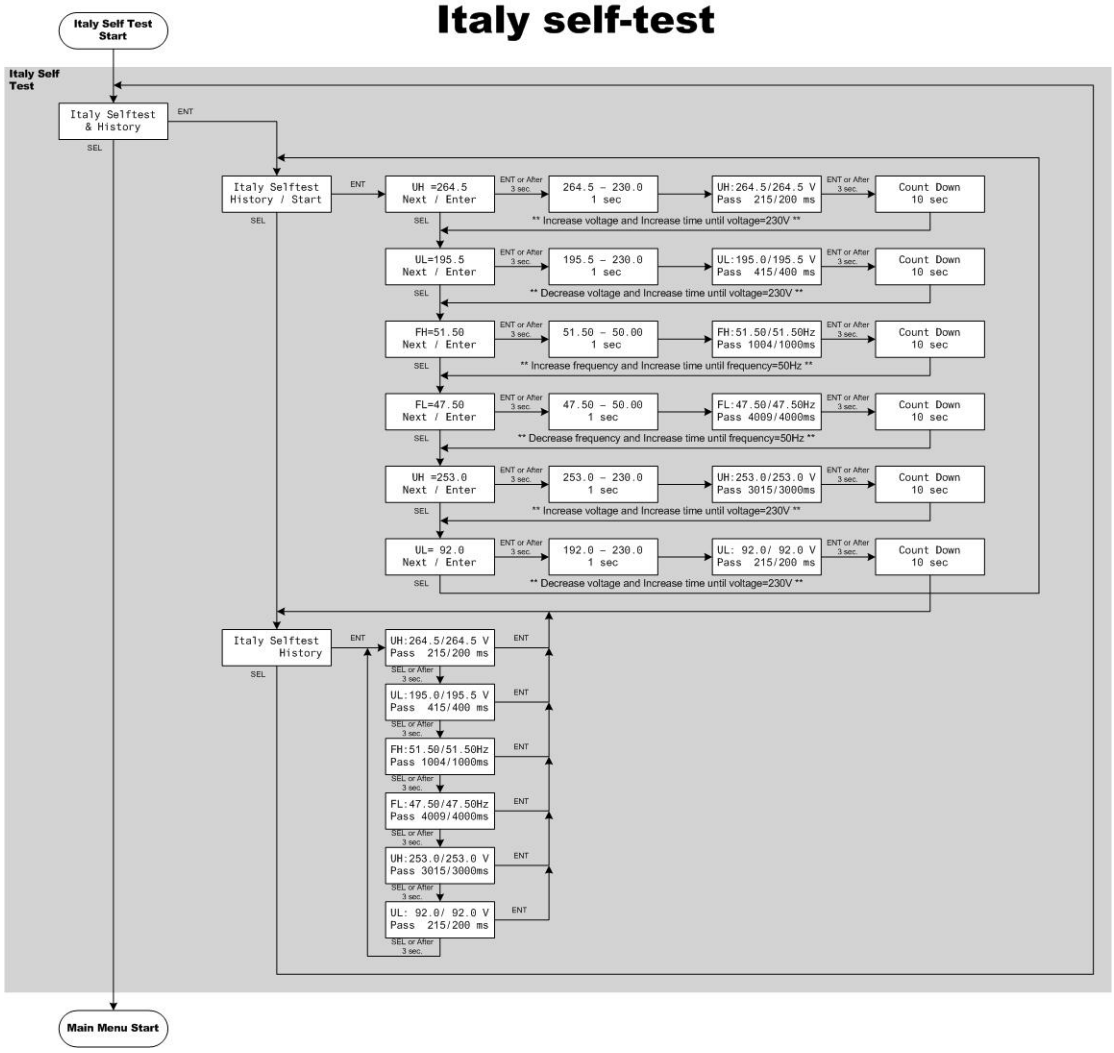

Italy self-test
Italy Self Test Start
Italy Self Test
Italy Selftest & History
ENT
SEL
Italy Selftest History / Start
UH =264.5 Next / Enter
ENT or After 3 sec.
264.5 – 230.0 1 sec
UH:264.5/264.5 V Pass 215/200 ms
Count Down 10 sec
** Increase voltage and Increase time until voltage=230V **
UL=195.5 Next / Enter
195.5 – 230.0 1 sec
UL:195.0/195.5 V Pass 415/400 ms
** Decrease voltage and Increase time until voltage=230V **
FH=51.50 Next / Enter
51.50 – 50.00 1 sec
FH:51.50/51.50Hz Pass 1004/1000ms
** Increase frequency and Increase time until frequency=50Hz **
FL=47.50 Next / Enter
47.50 – 50.00 1 sec
FL:47.50/47.50Hz Pass 4009/4000ms
** Decrease frequency and Increase time until frequency=50Hz **
UH =253.0 Next / Enter
253.0 – 230.0 1 sec
UH:253.0/253.0 V Pass 3015/3000ms
** Increase voltage and Increase time until voltage=230V **
UL= 92.0 Next / Enter
192.0 – 230.0 1 sec
UL: 92.0/ 92.0 V Pass 215/200 ms
** Decrease voltage and Increase time until voltage=230V **
Italy Selftest History
Main Menu Start

Figure 7-11 Italy self-test flowchart

8. Maintenance

In order to ensure the normal operation of PV Inverter, please check up regularly at least once each year or each half year. Check all the terminals, screws, cables are connected well. If there are any impaired parts, please contact with the qualified technician to repair or replace to the new spare part. To ensure that no foreign body stocks at the heat outlet, please clean up once a half year by qualified technicians.

WARNING！ Death and serious injuries may occur.
Before maintenance, please must disconnect AC and DC to avoid risk of electronic shock.

9. Measurement、Error Message and Trouble Shooting

9.1 Measurement

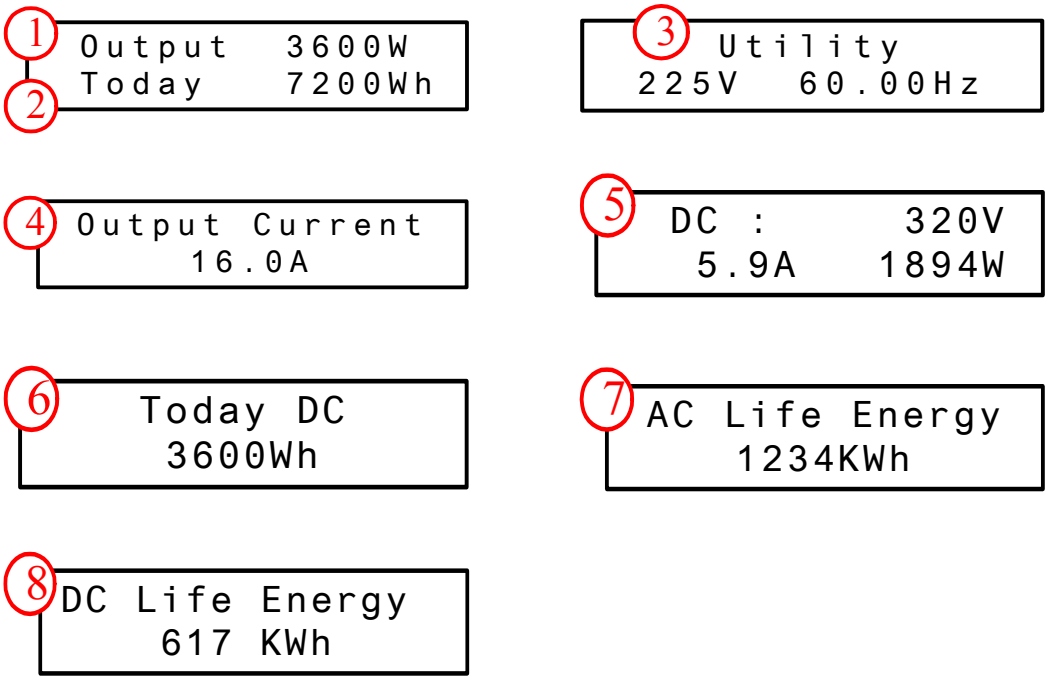


Table 9-1 Measurement and message

No.	Measurement	Meaning
1	Output	Actual power is generating
2	Today	Energy generated today
3	Utility	Grid Voltage and Frequency
4	Output Current	Actual Output AC current
5	DC	DC input Voltage、Current、Watt
6	Today DC	Today PV array energy supply .
7	AC Life Energy	Total Energy generated
8	DC Life Energy	Total PV array energy supply

9.2 Error Message & Trouble Shooting

Table 9-2 Error message

ERROR		
Message	**Possible cause**	**Action**
E01: Grid Freq Over Rating	1. Actual utility frequency is over the OFR setting 2. Incorrect country setting 3. Detection circuit malfunction	1. Check the utility frequency on the inverter terminal 2. Check country setting 3. Check the detection circuit inside the inverter
E02: Grid Freq Under Rating	1. Actual utility frequency is under the UFR setting 2. Incorrect country or Grid setting 3. Detection circuit malfunction	1. Check the utility frequency on the inverter terminal 2. Check country & Grid setting 3. Check the detection circuit inside the inverter
E07:Grid Quality	Non-linear load in Grid and near to inverter	Grid connection of inverter need to be far away from non-linear load if necessary
E09: No Grid	1. AC breaker is OFF 2. Disconnect in AC plug 3. Internal fuses are broken	1. Switch on AC breaker 2. Check the connection in AC plug and make sure it connects to inverter 3. Replace fuses and check all switching devices in boost & inverter stages
E10: Grid Volt Under Rating	1. Actual utility voltage is under the UVR setting 2. Utility voltage is under the Slow UVR setting during operation 3. Incorrect country or Grid setting 4. Detection circuit malfunction	1.&2. Check the utility voltage connection to the inverter terminal. 3. Check country & Grid setting 4. Check the detection circuit inside the inverter
E11: Grid Volt Over Rating	1. Actual utility voltage is over the OVR setting 2. Utility voltage is over the Slow OVR setting during operation 3. Incorrect country or Grid	1.&2. Check the utility voltage on the inverter terminal 3. Check country & Grid setting

	setting 4. Detection circuit malfunction	4. Check the detection circuit inside the inverter
E13: Slow Over Voltage Range	1. Actual utility voltage is over the OVR setting 2. Incorrect country or Grid setting 3. Detection circuit malfunction	1. Check the utility voltage on the inverter terminal 2. Check country & Grid setting 3. Check the detection circuit inside the inverter
E26:Slow Over Frequency Range	1. Actual utility frequency is over the OFR setting 2. Incorrect country or grid setting 3. Detection circuit malfunction	1. Check the utility frequency on the inverter terminal 2. Check country setting 3. Check the detection circuit inside the inverter
E27:Slow Under Frequency Range	1. Actual utility frequency is under the UFR setting 2. Incorrect country or Grid setting 3. Detection circuit malfunction	1. Check the utility frequency on the inverter terminal 2. Check country & Grid setting 3. Check the detection circuit inside the inverter
E28: Slow Under Voltage Range	1. Actual utility voltage is under the UVR setting 2. Incorrect country or Grid setting 3. Detection circuit malfunction	1. Check the utility voltage on the inverter terminal 2. Check country & Grid setting 3. Check the detection circuit inside the inverter
E30: DC Volt Over Rating	1. Actual Solar1 voltage is over 550Vdc (RPI-H3) or 1000Vdc (RPI-H5) 2. Detection circuit malfunction	1. Modify the solar array setting, and make the Voc less than 550Vdc (RPI-H3) or 1000Vdc (RPI-H5) 2. Check the detection circuit inside the inverter
E32: L/N Reversed	1. Incorrect AC wiring 2. Incorrect AC connection setting	1. Check if brown wire is connected to Line and blue wire is connected to Neutral. 2. Check display “AC configurat.” setting.
FAULT		
Message	**Possible cause**	**Action**
A01: DC Offset Over Rating	1. Utility waveform is abnormal 2. Detection circuit malfunction	1. Check the utility waveform. Grid connection of inverter need to be far away from non-linear load if necessary 2. Check the detection circuit inside the inverter

A05: NTC Over Temp	1. The ambient temp. is over 60℃ 2. Detection circuit malfunction	1. Check the installation ambient and environment 2. Check the detection circuit inside the inverter
A06: Inside NTC Circuit Fail	1. Ambient temp. >100℃ or <-24℃ 2. Detection circuit malfunction	1. Check the installation ambient and environment 2. Check the detection circuit inside the inverter
A08: Heat Sink NTC1 Fail	1. Boost heat sink temp. >100℃ or <-24℃ 2. Detection circuit malfunction	1. Check the installation ambient and environment 2. Check the detection circuit inside the inverter.
A09: Heat Sink NTC2 Fail	1. Inverter heat sink temp. >100℃ or <-24℃ 2. Detection circuit malfunction	1. Check the installation ambient and environment 2. Check the detection circuit inside the inverter
A15:DSP ADC Vgrid/Iout Fail	1. Auxiliary power circuitry malfunction 2. Detection circuit malfunction	1. Check the auxiliary circuitry inside the inverter 2. Check the detection circuit inside the inverter
A16:DSP ADC Vin/Vbus Fail	1. Auxiliary power circuitry malfunction 2. Detection circuit malfunction	1. Check the auxiliary circuitry inside the inverter 2. Check the detection circuit inside the inverter
A17:DSP ADC Iin/Iboost Fail	1. Auxiliary power circuitry malfunction 2. Detection circuit malfunction	1. Check the auxiliary circuitry inside the inverter 2. Check the detection circuit inside the inverter
A18:RED. ADC Vgrid Fail	1. Auxiliary power circuitry malfunction 2. Detection circuit malfunction	1. Check the auxiliary circuitry inside the inverter 2. Check the detection circuit inside the inverter
A19:DSP ADC Iout_dc Fail	1. Auxiliary power circuitry malfunction 2. Detection circuit malfunction	1. Check the auxiliary circuitry inside the inverter 2. Check the detection circuit inside the inverter
A20: Efficiency	1. The calibration is incorrect 2. Current feedback circuit is	1. Check the accuracy of current and power 2. Check the current feedback circuit inside

Inconsistent	defective	the inverter
A22: Internal Comm Fault_R	1. Red. CPU is idling 2. The communication connection is disconnected	1. Check reset and crystal in Red. CPU 2. Check the connection between Red. CPU and DSP
A23: Internal Comm Fault_D	1. DSP is idling 2. The communication connection is disconnected 3. The communication circuit malfunction	1. Check reset and crystal in DSP 2. Check the connection between DSP and COMM 3. Check the communication circuit
A24: Residual Curr Over Rating	1. PV array insulation fault 2. Large PV array capacitance between Plus to Ground or Minus to Ground 3. Either side of boost driver or boost choke malfunction 4. Detection circuit malfunction	1. Check the insulation of Solar inputs 2. Check the capacitance (+ <-> GND & - <-> GND), must < 2.5uF. Install an external transformer if necessary 3. Check boost driver & boost choke 4. Check the detection circuit inside the inverter
A25: Ground Fault	1. PV array insulation fault 2. Large PV array capacitance between Plus to Ground or Minus to Ground or both. 3. Detection circuit malfunction	1. Check the insulation of Solar inputs 2. Check the capacitance, dry PV panel if necessary 3. Check the detection circuit inside the inverter
A27: RCMU Circuit Fail	1. RCMU is disconnected 2. Detection circuit malfunction	1. Check the RCMU connection inside the inverter 2. Check the detection circuit inside the inverter
A28: Relay Short	1. One or more relays are sticking 2. The driver circuit for the relay malfunction	1. Replace the defective relay(s) 2. Check the driver circuit inside the inverter
A29: Relay Open	1. One or more relays are abnormal 2. The driver circuit for the relay malfunction 3. The detection accuracy is not correct for Vgrid and Vout	1. Replace the defective relay(s) 2. Check the driver circuit inside the inverter 3. Check the Vgrid and Vout voltage detection accuracy
A30: Bus Unbalance	1. Not totally independent or parallel between inputs 2. PV Array short to Ground	1. Check the inputs connections 2. Check the PV Array insulation 3. Check the driver circuit for boost inside

	3. Driver for boost is defective or disconnected 4. Detection circuit malfunction	the inverter 4. Check the detection circuit inside the inverter
A31: Bus_P Over Volt Rating	1. Driver for boost is defective 2. Voc of PV array is over 550Vdc (RPI-H3) or 1000Vdc (RPI-H5) 3. Surge occurs during operation 4. Detection circuit malfunction	1. Check the driver circuit for boost inside the inverter 2. Modify the solar array setting, and make the Voc less than 550Vdc (RPI-H3) or 1000Vdc (RPI-H5) 3. N/A 4. Check the detection circuit inside the inverter
A33: Bus_N Over Volt Rating	1. Driver for boost is defective 2. Voc of PV array is over 550Vdc (RPI-H3) or 1000Vdc (RPI-H5) 3. Surge occurs during operation 4. Detection circuit malfunction	1. Check the driver circuit for boost inside the inverter 2. Modify the solar array setting, and make the Voc less than 550Vdc (RPI-H3) or 1000Vdc (RPI-H5) 3. N/A 4. Check the detection circuit inside the inverter
A35: Bus Volt Over Rating	1. Driver for boost is defective 2. Voc of PV array is over 550Vdc (RPI-H3) or 1000Vdc (RPI-H5) 3. Surge occurs during operation 4. Detection circuit malfunction	1. Check the driver circuit for boost inside the inverter 2. Modify the solar array setting, and make the Voc less than 550Vdc (RPI-H3) or 1000Vdc (RPI-H5) 3. N/A 4. Check the detection circuit inside the inverter
A36:Output Curr Transient Over	1. Surge occurs during operation 2. Driver for inverter stage is defective 3. Switching device is defective 4. Detection circuit malfunction	1. N/A 2. Check the driver circuit in inverter stage 3. Check all switching devices in inverter stage 4. Check the detect circuit inside the inverter
A37: AC Curr Over Rating	Detection circuit malfunction	Check the detect circuit inside the inverter
A42: CT Current	1.Inverter choke Fail 2.Output Filter Fail	1. Check Inverter choke inductance. 2. Check output filter capacitance.

Sensor Fail	3. Detection circuit malfunction	3. Check the detection circuit inside the inverter
A45: HW OOCP	1. WB1 WB2 misconnection. 2. Detection circuit malfunction	1. Check the connection of WB1 and WB2. 2. Check the detection circuit inside the inverter
A50:Zero Cross Circuit Fail	The detection circuit for synchronal signal malfunction	Check the detection circuit for synchronal signal inside the inverter
A56:Hardware Incompatibility	1. HW power rating incorrect	1. Check comm. HW power rating info.
A60: DC Curr Over Rating	1. Switching device in boost is defective 2. Driver for boost is defective 3. Input current detection circuit malfunction	1. Check all switching device in boost 2. Check the driver circuit for boost inside the inverter 3. Check input current detection circuit
A70: DC Curr Transient Over	1. Switching device in boost is defective 2. Driver for boost is defective 3. Input current detection circuit malfunction	1. Check all switching device in boost 2. Check the driver circuit for boost inside the inverter 3. Check input current detection circuit

10. De-Commissioning

De-Commissioning Procedure

If it is necessary to put the device out of operation for RMA or maintenance, please follow the instructions below.

WARNING！ Death and serious injuries may occur.
To avoid injuries, please follow the procedures below,

1. Switch off AC circuit breaker to disconnect with electricity grid.
2. Switch off the PV Array switch to disconnect with PV Array.
3. Use proper voltage meter to confirm that the AC and DC power present totally absent.
4. Remove the AC wiring immediately to completely disconnect with electricity grid.
5. Remove the DC wiring to disconnect with PV Array.
6. Remove the Communication module RS-485 with the computer connection.

After finishing all the procedures, users can remove this machine.

11. Technical Data

11.1 Specifications

Table 11-1 Specifications

	RPI-H3	RPI-H5
GENERAL		
Enclosure	Powder coated aluminum	
Operating temperature	-20~60℃, full power up to 40℃	
Relative humidity	0% – 95% non condensing.	
Galvanic isolation	NO	
Safety class	Class I metal enclosure with protective earth	
Overvoltage category	III	
DC INPUT (Solar side)		
Maximum input power	3200W	5425W
Normal voltage	350 Vdc	650 Vdc
Operating voltage range	125~550 Vdc	200~1000 Vdc
Absolute maximum voltage	550 Vdc	1000 Vdc
MPP range (rated power)	320~500 Vdc	310~850 Vdc
MPPT tracker	1	
Maximum input current	10 A	17.5 A
Startup voltage	150 Vdc	250 Vdc
Input connection	MC4, 2 pairs	
AC OUTPUT (Grid side)		
Rated power	3000 VA	5000 VA
Maximum power	3000 VA	5000 VA
Voltage	230Vac +/-20%	
Rated current	13 A	21.7 A
Max. current	14.3 A	24.5 A
Frequency	50/60 Hz	
Total harmonic distortion	<3% with Rated power(#1)	
Power factor	>0.99@Rated power(#1)	
Peak efficiency	97.00%	97.50%
EU efficiency	96.2%	97.00%
Output connection	IP 67 single-phase	

Fuse		Internal fuse, 20 A/250 V*1	Internal fuse, 20 A/250 V*2
MECHANISM			
Housing		Aluminum Extrude	
Cooling		Natural cooling	
IP rating		IP65	
External communication		2 RS-485 connection	
Weight		15 kg	21.5 kg
Dimensions		367 × 420 × 157 mm	482 × 470 × 167 mm
REGULATIONS & DIRECTIVES			
Safety		IEC 62109-1 IEC 62109-2 CE compliance	
Grid interface		VDE 0126 A1 VDE AR-N 4105 UTE C 15-712-1	VDE AR-N 4105 RD1699 CEI-021
Emission		IEC 61000-6-4, IEC 61000-6-3	
Harmonics		EN 61000-3-12	
Variations and flicker		EN 61000-3-11	
Immunity		EN 61000-6-2	
Immunity	ESD	IEC 61000-4-2	
	RS	IEC 61000-4-3	
	EFT	IEC 61000-4-4	
	Surge	IEC 61000-4-5	
	CS	IEC 61000-4-6	
	PFMF	IEC 61000-4-8	

#1:Disable reactive power control

Appendix A

Multi-function Relay

Inverter support one multi-function relay, the multi-function relay is available to external devices. The device includes: flashing lights, Buzzer Etc. the multi-function relay allow following configuration.

- Fault indicator or Grid status indicator
- Power production
- Control of external loads
- Fan control

A.1 Multi-function relay output connection

The Dry contact connection provides a remote indication of inverter status. When inverter operated in the normal condition, the dry contact is closed. User can use the Monitor modbus SW tool, the multi-function relay will be configured as mentioned event setting. Please refer to *Figure A-1*

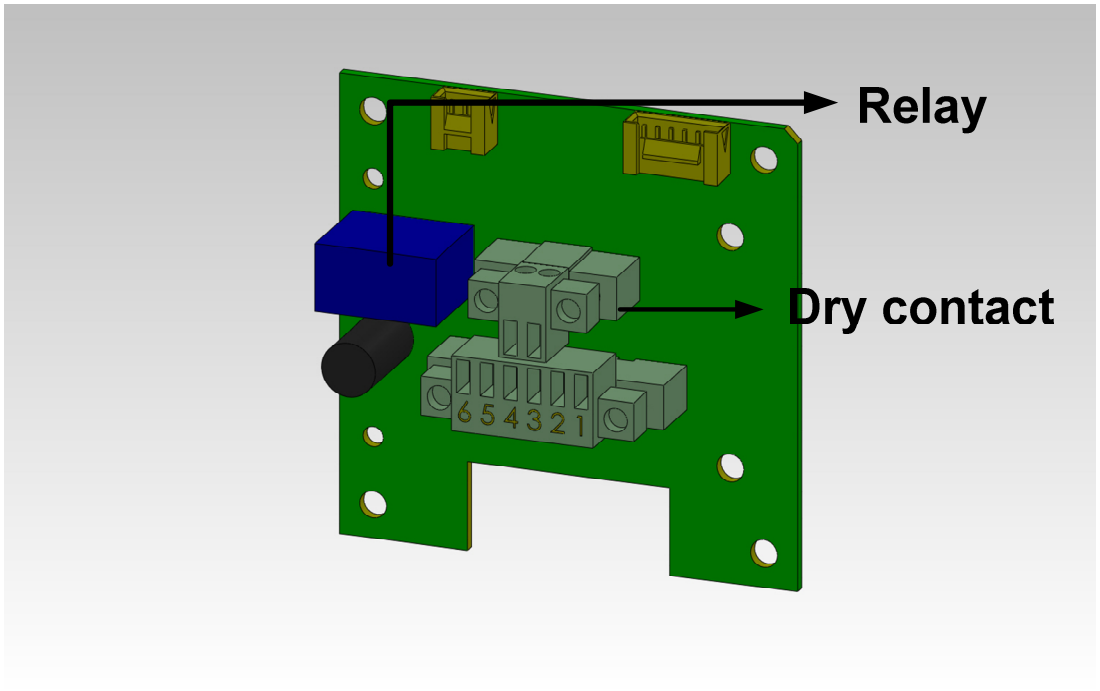


Figure A-1 Multi-function relay on Dry contact

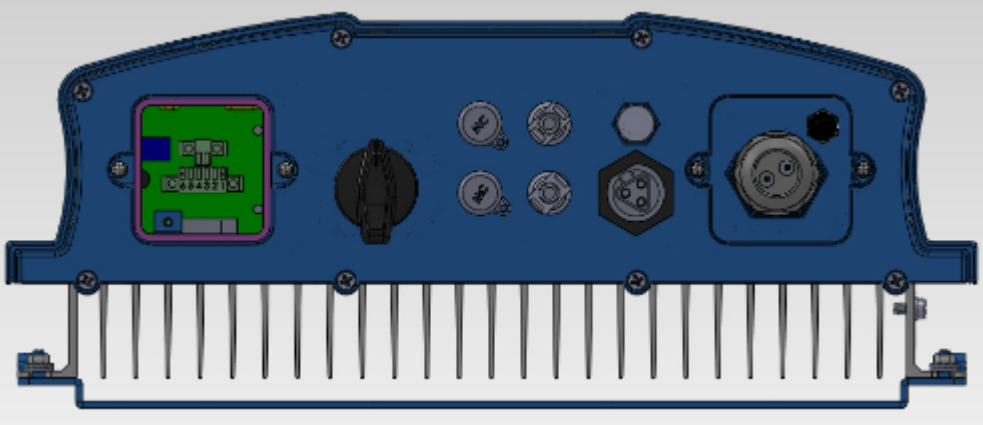


Figure A-2 Dry contact location

Danger ！Hazard of Electric shock.
Touching electronic components can damage components through electrostatic discharge.

Appendix B

Digital Input

To implementation of power management, the digital input interface receives the specifications of the network operator via a ripple control receiver.

- Germany : the active power limitation in the stages 0%, 30%, 60% and 100%
- Italy: Power output of Max 6KW for PV plant installation.
  a. Remote shutdown
  b. Narrow Frequency limits between 49.5 Hz to 50.5Hz.
- Customer: User defined.

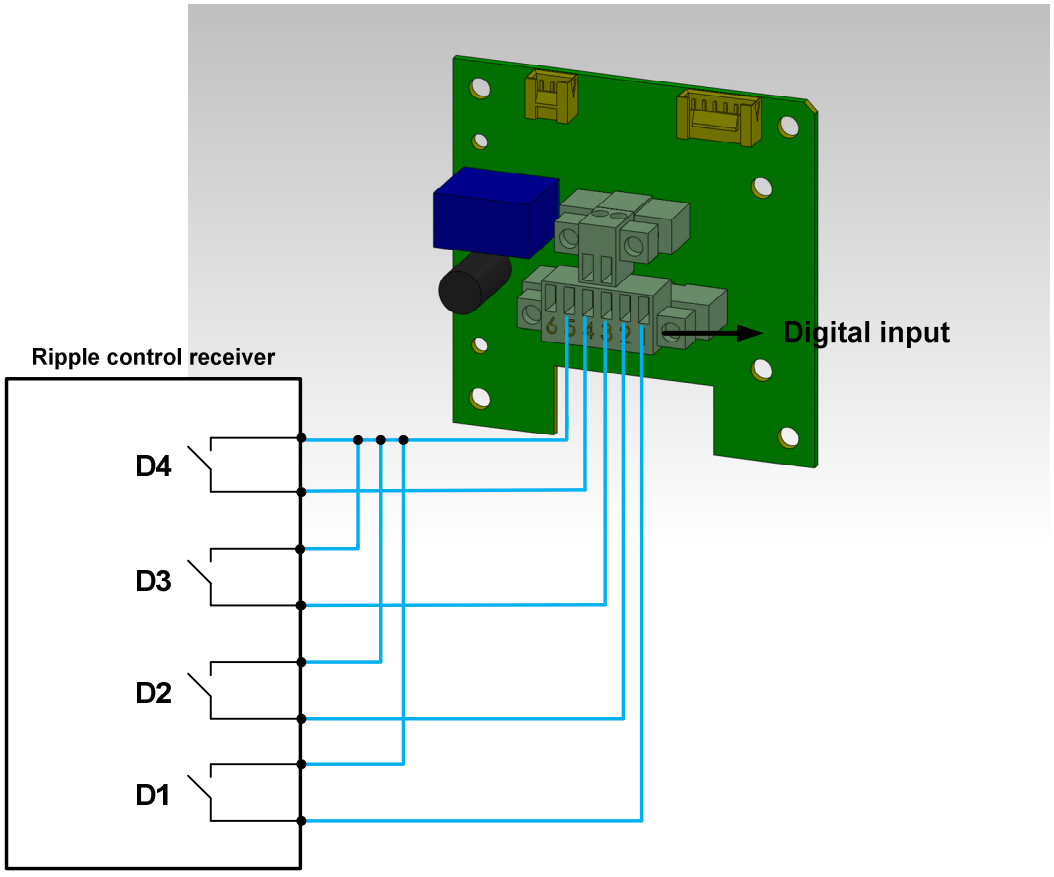


Figure B-1 Pin assignment at ripple control receiver

The inverter gives a voltage to Digital Input 5 & 6, and measures Digital Input 1 to 4. The inverter can detect the state of the relay of the ripple control receiver. The information which relay shall be controlled parameter by the network operator.

Pin	Function
1	Digital input 1
2	Digital input 2
3	Digital input 3
4	Digital input 4
5	Output 1
6	Output 2

Country = Italy & Italy with SPI

Function	D1	D2	D3	D4	Output 1	Output 2
No function	0	0	0	0	1	1
Remote off	1	0	0	0	1	1
Narrow frequency limit.	0	1	0	0	1	1

Note: 1 = Relay is closed, 0 = Relay is open.

Country = Germany

Function	D1	D2	D3	D4	Output 1	Output 2
No function	0	0	0	0	1	1
Active power = 0%	1	0	0	0	1	1
Active power = 30%.	0	1	0	0	1	1
Active power = 60%	0	0	1	0	1	1
Active power = 100%	0	0	0	1	1	1

Note: 1 = Relay is closed, 0 = Relay is open.

Cable requirements:

- Conductor cross-section: 0.205 mm^2 (AWG24) ~ 0.081 mm^2.(AWG28)
- Outside diameter of cable : 3.8mm ~ 5.2mm
- Please refer to UL 2464 computer cable guideline